

B12/B17 Interoperability; Many Consumer Benefits without any Material Carrier Burdens

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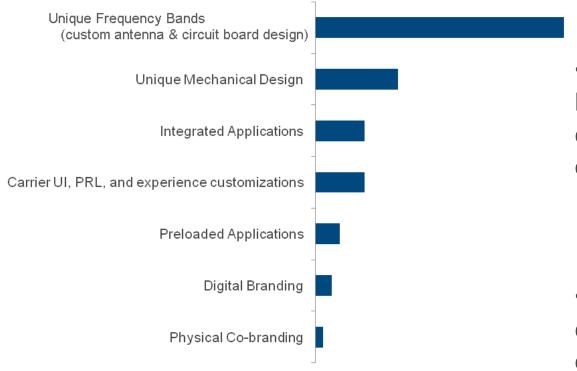
Summary

- <u>Request</u>: An FCC order requiring Lower 700 MHz operators to only provide devices that are capable of operating on all paired lower 700 MHz bands within 6 months of ruling.
- Benefits of an interoperability order
 - Single development platform to support lower 700 MHz
 - Removal of over \$200M+ in annualized device/platform development costs.
 - Access to more devices will provide consumers with greater choice and more competitive alternatives
 - Improved timing of devices to market relative to the time advantage enjoyed by the other national carriers
- Band 12 plus Band 17 devices can be achieved without the imposition of any material cost to AT&T or the device manufacturers



Single development platform

Carrier Customization Complexity



- •Antenna design changes have the greatest impact to device vendor development costs
 - Development and test resources
 - Time to Market
 - Program cost
- •Unique electrical variations drive management of a carrier unique SKU
- Relative complexity +



Single development platformiPhone 5

Model Number ²	LTE Band Support ³
Model A1428 (GSM model)	4 (AWS) 17 (700b MHz)
Model A1429 (CDMA model)	1 (2100 MHz) 3 (1800 MHz) 5 (850 MHz) 13 (700c MHz) 25 (1900 MHz)
Model A1429 (GSM model)	1 (2100 MHz) 3 (1800 MHz) 5 (850 MHz)

 Model A1429 (single hardware platform) supports both CDMA and GSM

 CDMA and/or GSM are enabled through software

Source: Ars Technica



Single development platform

Economics of standalone B12

- Unique B12 Platform development per device = \$15-\$30M
- Platforms developed per year = 12-15
- Total B12 development costs in excess of \$200M (\$180M to \$450M)

VS.

Economics of common B12/B17

- Additional band validation for AT&T devices = ~\$1.5M
 - Estimated at 30 devices at \$50k per year



U.S. Cellular Access & Timing to Top Tier OEM's Devices

Vendor	Status	Discussion
Α	Access to portfolio	Majority of device spend aggregated to insure access
В	No access	Will not develop to B12
C, D, E	No access	Will develop to B12 with prohibitive volume commitments
F	Delayed access	Will develop to B12 only after other platforms are introduced

M2M	No B12 LTE embedded module is currently available	
OS Diversity	Only 1 of the 4 largest smartphone OS are currently available to B12 operators	



Limited B12 Impact to AT&T

- The only hardware design change is replacing the Band 17 Duplexer and RX Filter with Band 12 components.
- Device software must be updated to support both Band 12 and Band 17.
- This upgraded device will be able to operate on Band 12 or Band 17 networks - No network upgrade required.
- The only incremental cost would be associated with validating the additional band support. This cost is estimated to be \$50,000 per device platform.



Benefits of Interoperability

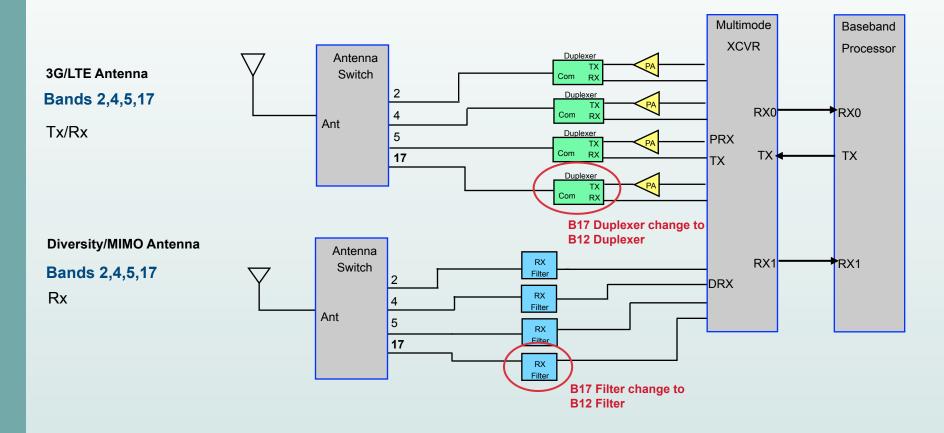
- It enables more consumer choice
- It will decrease cost and complexity in the wireless ecosystem, which will enable improved investment in networks and future technology
- It has minimal impact on AT&T
- It will motivate and enable broader utilization of Lower 700 MHz A block licenses to create more competition and put more spectrum to use at a time when the FCC has signaled a "looming spectrum crisis"



APPENDIX



Device RF Diagram





Additional Benefits

- If AT&T deploys a dual band solution that includes Bands 12 and 17, many benefits are immediate:
 - All Lower 700 MHz customers will enjoy an expanded roaming footprint across the country.
 - Public Safety will benefit from greater interoperability across rural America.
 - A Block Licensees will be able to purchase identical data-only devices (tablets, wi-fi hotspots and laptop dongles) yielding immediate handset ecosystem benefits.
- Widespread VoLTE deployment in 2014 will accelerate ecosystem benefits further by collapsing GSM/CDMA. At this point, significant consumer device portability benefits will flourish.
- An interoperability requirement will create incentives for carriers to rapidly deploy VoLTE.



B12 & B17 Component Details

- B12 duplexers are pin-compatible with B17 duplexers
- B12 filters are pin-compatible with B17 filters
 - no circuit board change
- Commercially available components
 - B12 duplexer: Epcos B7931, Murata SAYFH707MCA0F0A
 - B17 duplexer: Epcos B7924, Murata SAYFH710MCE0F0A
 - Similar cost
 - B12 filter: Murata SAFEA737MCL0F00
 - B17 filter: Murata SAFEA740MCL0F00
 - Similar cost
- All other device RF components support both Band 12 & 17

